APPENDIX 1

Curis Resources (Arizona) Inc.
ISCR Facility Operations Plan

Curis Resources (Arizona) Inc.
In-Situ Copper Recovery Facility Operations Plan

1. Introduction

This document provides a description of monitoring, control, and reporting requirements associated with the operation of the Florence Copper Project (FCP) in-situ copper recovery (ISCR) facilities in compliance with an Underground Injection Control (UIC) Permit. The methods and procedures described in this Operations Plan incorporate the detailed provisions contained in Attachments H, K, O, and P of the application that Curis Resources (Arizona) Inc. (Curis Arizona) submitted to the United States Environmental Protection Agency (USEPA) on March 31, 2011 to transfer, with modifications of UIC permit AZ 396000001 (UIC Application). The injection and recovery system will employ devices for metering flow and pressure, and for manually or automatically shutting down flow when alarm conditions occur. The metering devices will be monitored in a central control room and will provide sufficient information to allow the operator to maintain hydraulic control on a daily basis. Within the control room, the operator will have direct access to the necessary controls for shutting down the injection and extraction systems in response to unanticipated conditions.

Table 1, *ISCR Facility Operations Plan (Monitoring and Response Requirements)* provides a summary of methods and procedures related to Phase 1 (Production Test Facility [PTF]) operations and Phase 2 (commercial) operations. The table identifies major components of the ISCR process; devices by which the components are to be monitored; the operating conditions to be monitored; possible causes of those conditions; immediate responses required if conditions exceed specified limits; and required follow up actions. The monitoring devices will be electronically linked to the facility control room in order to provide a continuous assessment of conditions in the ISCR area, the pipeline corridor, and process area.

2. Operations

2.1 Pre-Operational Review

Before commencing ISCR operations, operations personnel will conduct a pre-operational review of all equipment, monitoring devices, and procedures to ensure that the operations comply with the following permit conditions.

1. Mechanical integrity tests (Part I and Part II) have been conducted on all ISCR wells in the ISCR well field, and all wells have passed the tests.
2. All wells have been completed such that they will not inject solutions within the uppermost 40 feet of the oxide zone (injection exclusion zone).
3. All coreholes and non-Class III wells located within 500 feet of the PTF test well block or an operational unit being readied for operations has been abandoned in accordance with the approved Plugging and Abandonment Plan.
4. Allowable injection pressure set not to exceed 0.65 pounds per square inch per foot (psi/ft) for each injection well.
5. Fresh groundwater has been injected, as needed, to assess the hydraulics of the injection and recovery patterns and to confirm that all monitoring devices and controls are in working order.

2.2 Injection System and Monitoring Devices

The injection system consists of individual injection wells, pumps, manifolds, piping, flow meters, and related controls. Manifolds will be used in both Phase 1 and 2 to distribute lixiviant to injection wells and to collect pregnant leach solution (PLS) from recovery wells.

2.2.1 Injection Pressures

The proposed Class III injection wells may be operated in one of two modes; pressurized at the well head, or under atmospheric well head pressures.

To ensure that injection pressures do not induce additional fracturing of the oxide zone, the UIC Permit established a fracture gradient limit of 0.65 psi/ft. Maximum injection pressures are determined by multiplying the fracture gradient limit (0.65 psi/ft) by the depth from the top of well casing to the top of the injection interval. This method of calculating maximum injection pressures reflects the pressure generated by the weight of the column of raffinate and an additional pressure applied by mechanical means to achieve the maximum allowable injection pressure at depth.

2.2.2 Injection Monitoring and Controls

Mechanical controls and monitoring devices incorporated into the injection system include:

- a pressure gauge at each injection manifold with set points;
- a flow meter at each injection manifold for measuring flow rates (gallons per minute [gpm]);
- a totalizing flow meter for measuring cumulative flow (gallons) into each injection manifold;
- an isolation valve at each injection well;
- a flow meter at each injection well for measuring flow rates (gallons per minute [gpm]); and
- a valve at each injection well for controlling flow.

Operators will use the gauges and meters at each injection manifold as devices for monitoring injection pressures and flows on a manifold-by-manifold basis. Allowable injection pressure will be calculated for each injection well. Actual pressures measured at each manifold will be compared to the maximum allowable pressure(s) for the well with the lowest allowable pressure, and will be adjusted as necessary to ensure injection pressures are within calculated allowable limits.

Every 24 hours, the totalized flows from all of the injection manifolds will be summed and compared to the summed totalized flows from all of the manifolds from recovery wells, hydraulic control (HC) wells, and IRZ restoration wells. If the summed total flow out of the injection and recovery zone (IRZ) exceeds the total flow into the IRZ, hydraulic control is confirmed. If the summed total flow out of the IRZ does not exceed the total flow into the IRZ, adjustments to recovery and/or injection flow rates will be made accordingly to restore hydraulic control.

Reduced flow in an injection well may be due to changes in formation characteristics or clogging of the formation or the well screens. A sudden increase in flow may indicate a break/failure of the well casing. If a casing breach is believed to have occurred, the operator will shut down that well by closing the well head isolation valve and will conduct relevant inspections. Inspections and related reporting will be conducted in accordance with Plans for Well Failures (Attachment O).

The injection and recovery systems will be connected to one or more tank farms in the ISCR area. The tank farms will include tanks fitted with a high-level alarm and level indicators. Both alarm and level indicator signals will be routed to the control room. An alarm will actuate if either a line fails or the tank high level is exceeded. The feed pump to the tank will be disabled automatically. Spilled

solutions will be captured in a lined collection sump able to contain 110 percent of the volume of the tank and line. The spilled volume will be pumped back into the circuit for reuse.

Solutions pumped through pipelines located in pipeline channels between the ISCR area and the process area will be metered for flow and pressure. For Phase 2 operations, four lines may be used in the pipeline channels: lixiviant, PLS, hydraulic control solution (HCS), and a fourth line to be used as a backup in case one of the other three lines fails. An electronic monitoring system will alarm if a pump fails, flow is interrupted, or flow is not in logical mode when a pump is activated. Loss of pressure or pressure exceeding a high setting will cause the pump to automatically shut down. In the event of such an occurrence, the plant operator will inspect the system. A broken line will be repaired within 72 hours and spilled solutions captured in spill control sumps in the lined channels will be pumped back into the process systems or to the water impoundment.

2.2.2.1 Recovery System Monitoring and Controls

The recovery system is similar to the injection system. It is comprised of individual recovery wells, pumps, recovery manifolds, piping, and related meters and controls, and includes:

- a continuous reading flow meter (gpm) at each recovery manifold;
- a totalizing flow meter (gallons) at each recovery manifold;
- an isolation valve at each recovery well;
- a flow meter at each recovery well; and
- a pressure transducer within perimeter and selected recovery wells for measuring head/water elevation within an IRZ (to assess hydraulic control).

The flow meters on the recovery manifolds will allow the operators to monitor recovery flow rates and use the data (with that from the hydraulic control and reclamation wells) to compare against injection flow rates as described above. As necessary, recovery flow can be adjusted in the manifolds to ensure that flow out of the operational unit exceeds the flow of lixiviant and any other injectate into the operational unit. Inspections and related reporting will be conducted in accordance with Plans for Well Failures (Attachment O.)

2.2.2.2 Hydraulic Control

Hydraulic control must be maintained from the time that lixiviant injection begins until the groundwater quality in the IRZ has been restored to a quality that meets closure criteria in the Aquifer Protection Permit (APP) and the UIC Permit.

Hydraulic control is defined as a condition involving an inward groundwater gradient. It is maintained by pumping more solution from the IRZ than is injected into the IRZ, and is used to prevent in-situ solutions from migrating beyond the IRZ.

In-line flow meters will be used to monitor and verify that the volume of PLS pumped from recovery wells exceeds the amount of lixiviant injected to confirm hydraulic control. In addition, the presence of an inward hydraulic control will be monitored on a daily basis by comparing water levels in paired wells along the perimeter of the IRZ. Hydraulic control is confirmed when the water level in the outer well is higher than the water level in the inner well of each well pair.

3. Operational Monitoring

Table 1 (attached) summarizes operational monitoring methods and procedures that will be used during Phase 1 (PTF) operations and Phase 2 (commercial) operations. Table 1 is designed to provide for the identification and correction of any problem related to the storage or flow of ISCR solutions before the solutions reach surface soils, the vadose zone, or groundwater outside the IRZ. The monitoring methods and procedures are also designed to monitor and maintain hydraulic control and thereby prevent ISCR solutions from migrating beyond the IRZ. Table 1 is not intended to cover the sampling and analysis of groundwater or ISCR solutions because of the complexity of the required equipment and procedures. However, references are provided in Section 1 for all related sampling and analysis requirements.

3.1 Emergency Response/Contingency Plan Requirements Emergency Conditions

The following conditions will cause activation of the contingency plan.

1. Spills of sulfuric acid, raffinate, or PLS outside containment structures that are in excess of the reportable quantities set forth in 40 CFR 302 et seq.
2. Loss of hydraulic control within an operational unit for more than 72 consecutive hours. For purpose of this requirement, loss of hydraulic control means that the amount of fluids injected during a 72-hour period exceeds the amount of fluid recovered during the same 72-hour period, and/or that the average head reading for any observation pair for a 72-hour period indicates a flat or outward gradient.
3. Failure of transducers in any observation pair for more than 72 hours.

3.2 Emergency Response Actions

The occurrence of any of the conditions described above will result in:

1. The activation of the notification procedures set forth in the APP.
2. Immediate containment of the spilled material, return of collected liquids to the process or to the evaporation ponds, disposal of contaminated soils in the water impoundment(s), and disposal of other debris in approved off-site facilities.
3. Immediate cessation of injection until such time that hydraulic control has been established and recovery wells have operated a sufficiently long period of time to compensate for the amount of fluid that was injected in excess of the amount recovered during the 72-hour period.

4. Recordkeeping and Reporting

Operational reporting will be conducted at two levels; daily and quarterly. Curis Arizona operators will complete a daily operations log that includes each of the daily monitoring requirements and calculations described above, and other entries related to the injection and recovery process. These logs will be maintained on site and be available for inspection for a period of two years. Quarterly monitoring reports will be submitted to the Arizona Department of Environmental Quality (ADEQ), and will include summaries of pertinent data from the daily operations log, as well as water quality sampling results for the POC wells. Copies of the quarterly reports will be maintained on site until commencement of the post-closure period.

4.1 Daily Operations Log

The daily operations log will include the following:

- Daily cumulative flow rates for each of the injection and recovery manifolds.
- Daily cumulative total flow rates for the all of in the injection and recovery manifolds combined.
- Daily average water level readings for each perimeter/recovery well pair.
- List of injection and recovery wells shut down in response to alarm conditions, and actions taken to correct the alarm conditions noted. This information will include well identification, shut down time, and estimate of excess injection flow occurring prior to shut down.

4.2 Quarterly Monitoring Report

Quarterly monitoring reports will be submitted to ADEQ and USEPA within 45 days following the end of each calendar quarter. The quarterly reports will include:

- A table showing POC monitoring well analytical results and alert levels (ALs) with a narrative summary of those results.
- Results of monthly analysis of organics in raffinate.
- A table and graphs showing daily average head in the paired perimeter and observation wells.
- A table and graph showing daily cumulative injection and recovery flow in each active production unit over the reporting period.
- Results of monitoring required by 40 CFR 146.33(b)(i) whenever the injection fluid is modified to the extent that previously reported analyses are incorrect and incomplete.
- Results of mechanical integrity testing completed during the reporting period.
- A map showing current operational unit status.
- A list of wells and coreholes abandoned during the reporting period, and a list of wells and coreholes to be abandoned during the next reporting period.